

# Diabetic Foot Ulcers

Reconstruction of diabetic foot ulcers is a challenge, and the therapy is an alternative to promote open wound healing.

REVIEWED BY ABDULLAH ETÖZ, MD

**N**egative pressure wound therapy (NPWT) may be an alternative technique to achieve a faster granulating wound bed in patients with diabetic foot ulcers. This procedure may successfully prepare the wound bed for other closure techniques, according to researchers reporting in *Wounds*.<sup>1</sup>

Abdullah Etöz, MD, and colleagues from the department of plastic and reconstructive surgery at Uludag University in Bursa, Turkey, compared NPWT with traditional moist gauze dressing as a treatment used before flaps, grafts or other wound closure techniques.

"Reconstruction of diabetic foot ulcers is often a challenging problem," Dr. Etöz and colleagues wrote. "The impairment of the healing process and the lack of resistance against infections in patients with diabetes present a familiar clinical problem. High treatment costs and unsatisfactory results are common," they added.

## NEGATIVE PRESSURE WOUND THERAPY

- Wounds were covered with polyurethane ether sponge, and a tube was placed underneath the sponge.
- Tube and sponge were covered for an airtight seal. Tube was connected to a medical aspirator pump to create negative pressure.
- 125 mm Hg of continuous negative pressure was used, and the sponge and tube were changed every 48 hours.
- Before changing sponges, IV analgesics were given.

Typically, a diabetic wound with a loss of soft tissue is surgically closed with split-thickness skin grafts or transposition grafts. The authors point out that immediate closure is prone to failure because of the patient's condition and the nature of the wound. To prepare the wound bed for final closure, the initial step would be standard wound care of moist gauze dressing.

## OPEN WOUND HEALING

NPWT was developed as an alternative to promote healing of an open wound.<sup>2</sup> Clinical studies have shown that negative pressure increases blood flow to the wound, helps granulation tissue form and decreases bacteria formation. The wound heals faster, which decreases hospitalization rates and additional chronic problems.

For this study, Dr. Etöz and colleagues identified 24 diabetic patients with nonhealing, lower extremity wounds. The patients were prospectively randomized in double-blind fashion to NPWT with a standard medical aspirator system (Bicakcilar Inc., Istanbul) or control using a saline-moistened gauze dressing changed twice daily.

## GROUP STATISTICS

Of the group studied, 17 had insulin-dependent diabetes, 15 had diabetic peripheral neuropathy with what was described as changing intensities and five had peripheral vascular dysfunction. One patient was being treated for chronic renal failure.

The mean age of patients in the NPWT group was 66.2 years and 64.7 years in the control group. Prior to treatment, patients assigned NPWT had a mean wound surface area of 109 cm<sup>2</sup> versus 94.8 cm<sup>2</sup> in the control group.

Figure 1. This diabetic foot wound of a 66-year-old man (A) was treated with NPWT. The application of the negative pressured wound dressing after wound debridement (B) led to these results after 10 days (C). The skin graft was taken and covered the wounds with satisfaction (D).

All ulcers were surgically debrided before initiation of treatment, and systemic antibiotics were given for prophylaxis. No signs of infection followed treatment, and all patients received multivitamins and nutritional supplements including zinc.

### MEASURED EVERY 48 HOURS

The investigators measured the wound surface areas every 48 hours. Therapy was continued in both groups until the wound beds were almost completely covered with granulation tissue and no inflammation was seen.

Patients in the NPWT group had an increased formation of granulation tissue and decreased nonviable tissue; edema in the extremities diminished in all patients, and the surface area of wounds decreased. NPWT patients had a mean treatment time of 11.25 days versus 15.75 days among control patients ( $P=.05$ ), the researchers reported.

The mean diabetic wound surface area decreased from 109 cm<sup>2</sup> to 88.6 cm<sup>2</sup> among the NPWT patients versus 94.8 cm<sup>2</sup> to 85.3cm<sup>2</sup> in the control group ( $P=.032$ ). Dr. Etöz and colleagues said that NPWT reduced the wound surface areas more effectively than moist gauze dressing ( $P<.05$ ).

After therapy, 19 of 24 wounds in either group had skin grafting, four had transposition of regional fasciocutaneous flaps for wound closure, and one in the NPWT group had wound closure using a distal pedicled fasciocutaneous flap based on sural vein and its concomitant arterial vessels. Investigators reported that three patients in the control group had wound closure by using distal pedicled fasciocutaneous flaps as two sural flaps and one safenous flap.

The wound bed rapidly granulated area was too narrow for surgical closure in one patient with NPWT. Physicians were satisfied with all skin grafts, and there was only one complication in control patients. No patients had signs of infection, and no adverse affects were noted with respect to function or psychology of the patients.

"In the treatment of diabetic ulcer wounds, NPWT provided a faster wound resolution compared to saline-moistened gauze," Dr. Etöz and colleagues said. "NPWT may be beneficial in diabetic nonhealing wounds of the lower extremity. The surface area of diabetic ulcers decreased by NPWT more effectively than most gauze dressings."

They concluded that the appropriate use of NPWT might be an alternative therapy to achieve faster granularized wound bed in diabetic foot ulcers in preparation for other closure techniques. "In this small study, the results of NPWT are hopeful. We wish to work on a larger cohort of patients. Further studies are needed to clarify the effects and indications and to modify the technique of this alternative treatment for nonhealing wounds."

### THE UNDIAGNOSED HYPOTHYROIDISM

Dr. Etöz said that in the treatment of diabetic microvascular complications such as diabetic foot ulcers, he and colleagues want to investigate the undiagnosed clinical hypothyroidism in these cases. In a report from John A. Bryant, MD, diabetic foot ulcers were associated with undiagnosed clinical hypothyroidism. Additional T3 and T4 therapy should be given if it is really required.

"Our study offers a method that may be applied easily in every wound clinic. Clinicians should try growth factors with NPWT on their patients. They should use standard negative pressure pumps in the treatment of non-healing diabetic wounds so they lower the treatment costs," Dr. Etöz said. ■

*Abdullah Etöz, MD, is from the department of plastic and reconstructive surgery and is a member of the medical faculty of Uludag University, Bursa, Turkey. He can be reached at +90 0224 442 84 00 +1119 or etoz@yahoo.com.*



1. Argenta LC, Morkywas MJ. Vacuum-assisted closure: A new method for wound control and treatment: clinical experience. *Ann Plast Surg.* 1997;38:563-567.
2. Etöz A, Ozgenel Y, Ozcan M. The use of negative pressure wound therapy on diabetic foot ulcers: A preliminary control approach. *Wounds.* 2004;16:264-269.